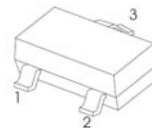




## FEATURES

- Complementary to MMBT3906

### SOT-23



1.BASE  
2.EMITTER  
3.COLLECTOR

### Marking

| Type number | Marking code |
|-------------|--------------|
| MMBT3904    | 1AM          |

## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

### MAXIMUM RATINGS (Ta=25°C unless otherwise noted)

| Parameter                                        | Symbol         | Value    | Unit |
|--------------------------------------------------|----------------|----------|------|
| Collector–Base Voltage                           | $V_{CBO}$      | 60       | V    |
| Collector–Emitter Voltage                        | $V_{CEO}$      | 40       | V    |
| Emitter–Base Voltage                             | $V_{EBO}$      | 6        | V    |
| Collector Current — Continuous                   | $I_C$          | 200      | mA   |
| Collector Power Dissipation                      | $P_C$          | 200      | mW   |
| Thermal Resistance From Junction To Ambient      | $R_{thJA}$     | 625      | °C/W |
| Operation Junction and Storage Temperature Range | $T_J, T_{stg}$ | -55~+150 | °C   |

### CLASSIFICATION OF $h_{FE}$

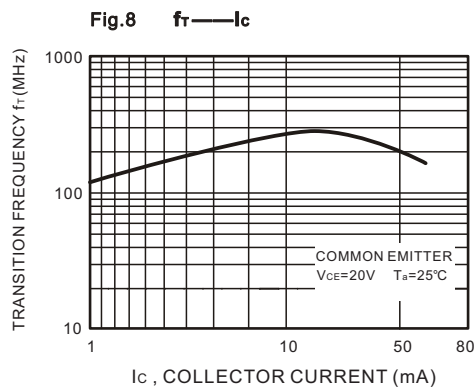
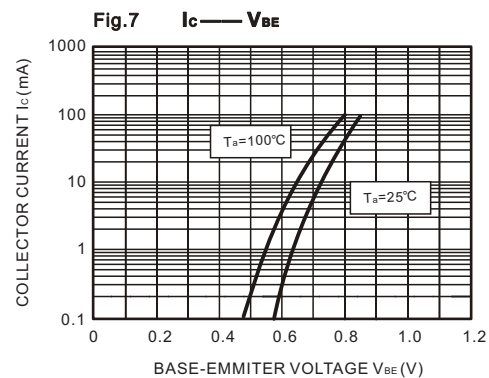
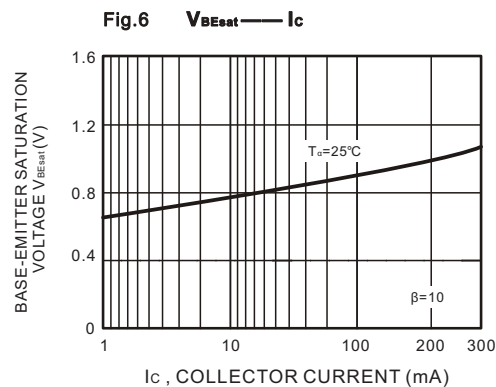
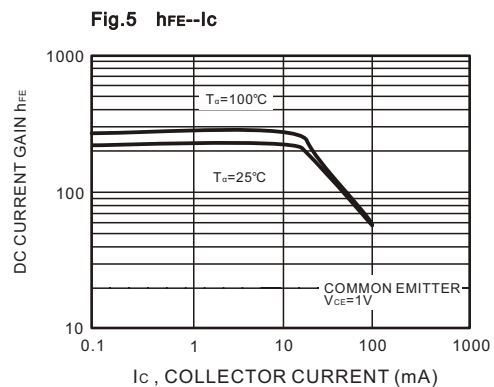
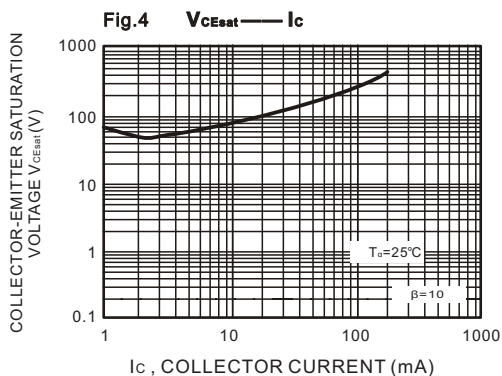
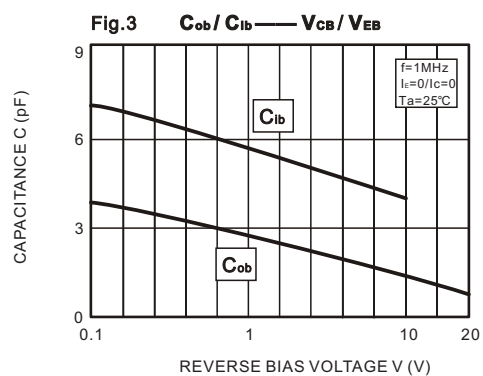
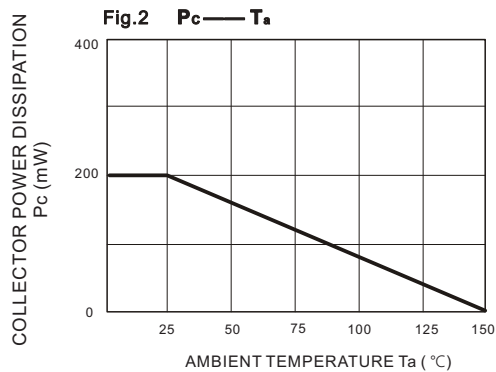
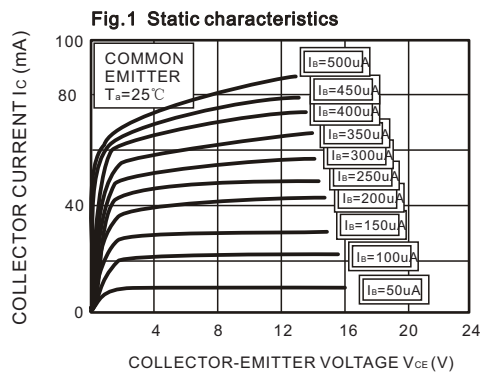
|       |         |         |
|-------|---------|---------|
| HFE   | 100-300 |         |
| Rank  | L       | H       |
| Range | 100-200 | 200-300 |

ELECTRICAL CHARACTERISTICS (TA = 25°C unless otherwise noted.)

| Parameter                            | Symbol        | Test conditions                                                            | Min | Typ | Max  | Unit |
|--------------------------------------|---------------|----------------------------------------------------------------------------|-----|-----|------|------|
| Collector-base breakdown voltage     | $V_{(BR)CBO}$ | $I_C = 10\mu A, I_E = 0$                                                   | 60  |     |      | V    |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$ | $I_C = 1\text{ mA}, I_B = 0$                                               | 40  |     |      | V    |
| Emitter-base breakdown voltage       | $V_{(BR)EBO}$ | $I_E = 10\mu A, I_C = 0$                                                   | 6   |     |      | V    |
| Collector cut-off current            | $I_{CEX}$     | $V_{CE} = 30V, V_{BE(off)} = 3V$                                           |     |     | 50   | nA   |
| Collector cut-off current            | $I_{CBO}$     | $V_{CB} = 60V, I_E = 0$                                                    |     |     | 100  | nA   |
| Emitter cut-off current              | $I_{EBO}$     | $V_{EB} = 5V, I_C = 0$                                                     |     |     | 100  | nA   |
| DC current gain                      | $h_{FE1}$     | $V_{CE} = 1V, I_C = 10\text{mA}$                                           | 100 |     | 300  |      |
|                                      | $h_{FE2}$     | $V_{CE} = 1V, I_C = 50\text{mA}$                                           | 60  |     |      |      |
|                                      | $h_{FE3}$     | $V_{CE} = 1V, I_C = 100\text{mA}$                                          | 30  |     |      |      |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = 50\text{mA}, I_B = 5\text{mA}$                                      |     |     | 0.3  | V    |
| Base-emitter saturation voltage      | $V_{BE(sat)}$ | $I_C = 50\text{mA}, I_B = 5\text{mA}$                                      |     |     | 0.95 | V    |
| Transition frequency                 | $f_T$         | $V_{CE} = 20V, I_C = 10\text{mA}, f = 100\text{MHz}$                       | 300 |     |      | MHZ  |
| Delay time                           | $t_d$         | $V_{CC} = 3V, V_{BE(off)} = -0.5V, I_C = 10\text{mA}, I_{B1} = 1\text{mA}$ |     |     | 35   | ns   |
| Rise time                            | $t_r$         |                                                                            |     |     | 35   | ns   |
| Storage time                         | $t_s$         | $V_{CC} = 3V, I_C = 10\text{mA}, I_{B1} = I_{B2} = 1\text{mA}$             |     |     | 200  | ns   |
| Fall time                            | $t_f$         |                                                                            |     |     | 50   | ns   |

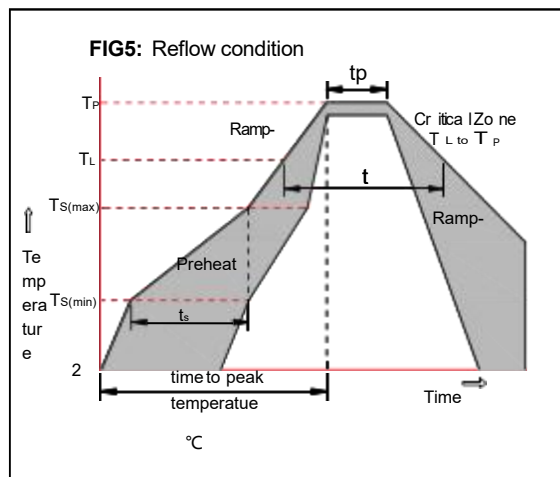


RATING AND CHARACTERISTIC CURVES



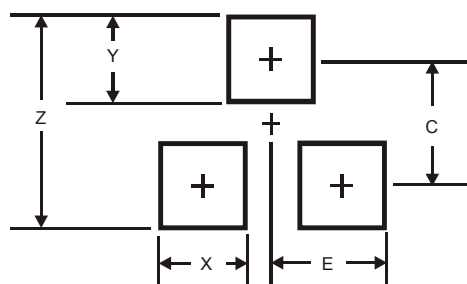
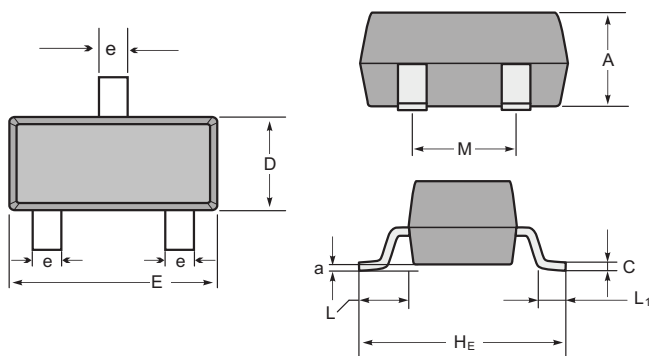
## Soldering parameters

| Reflow Condition                                        |                                   | Pb-Free assembly<br>(see as below) |
|---------------------------------------------------------|-----------------------------------|------------------------------------|
| Pre Heat                                                | -Temperature Min ( $T_{s(min)}$ ) | +150°C                             |
|                                                         | -Temperature Max( $T_{s(max)}$ )  | +200°C                             |
|                                                         | -Time (Min to Max) (ts)           | 60-180 secs.                       |
| Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max                       |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3°C/sec. Max                       |
| Reflow                                                  | -Temperature( $T_L$ )(Liquid us)  | +217°C                             |
|                                                         | -Temperature( $t_L$ )             | 60-150 secs.                       |
| Peak Temp ( $T_P$ )                                     |                                   | +260(+0/-5)°C                      |
| Time within 5°C of actual Peak Temp ( $t_P$ )           |                                   | 30 secs. Max                       |
| Ramp-down Rate                                          |                                   | 6°C/sec. Max                       |
| Time 25°C to Peak Temp ( $T_P$ )                        |                                   | 8 min. Max                         |
| Do not exceed                                           |                                   | +260°C                             |



## Package Dimensions & Suggested Pad Layout

### SOT23



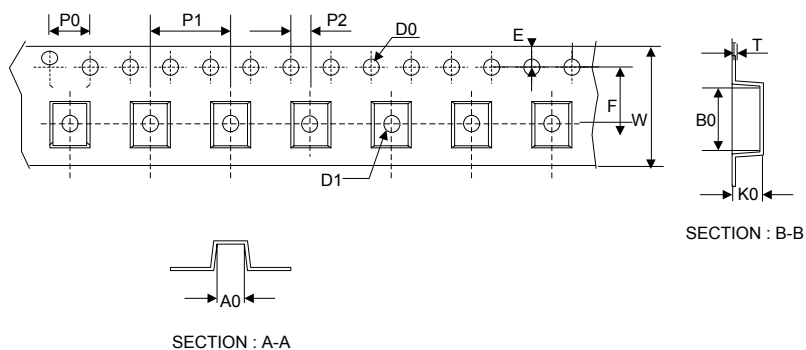
### SOT-23 mechanical data

| UNIT |     | A   | C    | D   | E   | H <sub>E</sub> | e   | M    | L             | L <sub>1</sub> | a    |
|------|-----|-----|------|-----|-----|----------------|-----|------|---------------|----------------|------|
| mm   | max | 1.1 | 0.15 | 1.4 | 3.0 | 2.6            | 0.5 | 1.95 | 0.55<br>(ref) | 0.36<br>(ref)  | 0.0  |
|      | min | 0.9 | 0.08 | 1.2 | 2.8 | 2.2            | 0.3 | 1.7  |               |                | 0.15 |
| mil  | max | 43  | 6    | 55  | 118 | 102            | 20  | 77   | 22<br>(ref)   | 14<br>(ref)    | 0.0  |
|      | min | 35  | 3    | 47  | 110 | 87             | 12  | 67   |               |                | 6    |

| Dimensions | SOT23 |
|------------|-------|
| Z          | 2.9   |
| X          | 0.8   |
| Y          | 0.9   |
| C          | 2.0   |
| E          | 1.35  |

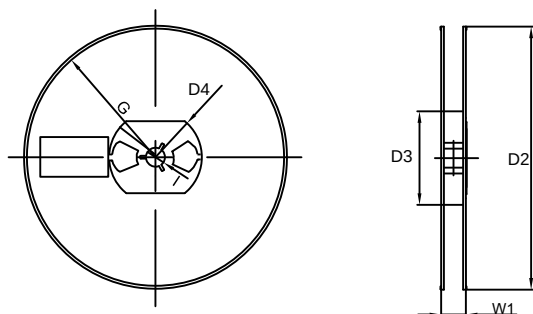
## Tape & reel specification

### Tape



| Symbol | Dimension (mm) |
|--------|----------------|
| P0     | 4.00±0.10      |
| P1     | 4.00±0.10      |
| P2     | 2.00±0.10      |
| D0     | 1.55±0.10      |
| D1     | 1.05±0.10      |
| E      | 1.55±0.10      |
| F      | 3.60±0.10      |
| W      | 8.00±0.10      |
| A0     | 3.80±0.20      |
| B0     | 3.25±0.20      |
| K0     | 1.45±0.10      |
| T      | 0.25±0.05      |
| D2     | 178.0±3.0      |
| D3     | 55Min.         |
| D4     | R24.0±3.0      |
| G      | R82.0±3.0      |
| I      | 13.0±2.0       |
| W1     | 11.0±3.0       |

### 7" Reel



Quantity: 3000PCS